NEMA Standards Publication

NEMA ICS 1-2000 (R2005, R2008, R2015)

Industrial Control and Systems: General Requirements

National Electrical Manufacturers Association

NEMA Standards Publication No. ICS 1-2000 (R2005, R2008, R2015)

Industrial Control and Systems
General Requirements

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Foreword

This standards publication was prepared by a technical committee of the NEMA Industrial Automation Control Products and Systems Section. It was approved in accordance with the bylaws of NEMA and supersedes the indicated NEMA Standards Publication. This standards publication supersedes ICS 1-1993.

This standards publication provides practical information concerning ratings, construction, test, performance and manufacture of industrial control equipment. These standards are used by the electrical industry to provide guidelines for the manufacture and proper application of reliable products and equipment and to promote the benefits of repetitive manufacturing and widespread product availability.

NEMA standards represent the result of many years of research, investigation, and experience by the members of NEMA, its predecessors, its sections and committees. They have been developed through continuing consultation among manufacturers, users and national engineering societies and have resulted in improved serviceability of electrical products with economies to manufacturers and users.

One of the primary purposes of this standards publication is to encourage the production of reliable control equipment which, in itself, functions in accordance with these accepted standards. Some portions of these standards, such as electrical spacings and interrupting ratings, have a direct bearing on safety; almost all of the items in this publication, when applied properly, contribute to safety in one way or another.

Properly constructed industrial control equipment is, however, only one factor in minimizing the hazards, which may be associated with the use of electricity. The reduction of hazard involves the joint efforts of the various equipment manufacturers, the system designer, the installer and the user. Information is provided herein to assist users and others in the proper selection of control equipment.

The industrial control manufacturer has limited or no control over the following factors, which are vital to a safe installation:

a. Environmental conditions
b. System design
c. Equipment selection and application
d. Installation
e. Operating practices
f. Maintenance

This publication is not intended to instruct the user of control equipment with regard to these factors except insofar as suitable equipment to meet needs can be recognized in this publication and some application guidance is given.

This standards publication is necessarily confined to defining the construction requirements for industrial control equipment and to providing recommendations for proper selection for use under normal or certain specific conditions. Since any piece of industrial control equipment can be installed, operated and maintained in such a manner that hazardous conditions may result, conformance with this publication does not by itself assure a safe installation. When, however, equipment conforming with these standards is properly selected and is installed in accordance with the National Electrical Code and properly maintained, the hazards to persons and property will be reduced.

To continue to serve the best interests of users of Industrial Control and Systems equipment, the Industrial Control and Systems Section is actively cooperating with other standardization organizations in the development of simple and more universal metrology practices. In this publication, the U.S. customary units are gradually being supplemented by those of the modernized metric system known as the International

Systems of Units (SI). This transition involves no changes in standard dimensions, tolerances, or performance specifications.

NEMA standards publications are subject to periodic review. They are revised frequently to reflect user input and to meet changing conditions and technical progress.

Proposed revisions to this standards publication should be submitted to:

Vice President, Technical Services
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, VA 22209

This standards publication was developed by the Industrial Automation Control Products and Systems Section. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Industrial Automation Control Products and Systems Section consisted of the following members:

ABB Control, Inc. – Wichita Falls, TX
Alstom Drives and Controls, Inc. – Pittsburgh, PA
Automatic Switch Company – Florham Park, NJ
Balluff, Inc. – Florence, KY
Carlo Gavazzi, Inc. – Buffalo Grove, IL
CMC Torque Systems – Billerica, MA
Control Concepts Corporation – Beaver, PA
Cooper Bussman – St. Louis, MO
Cummins, Inc. – Minneapolis, MN
Cyberex – Mentor, OH
Eaton Corporation – Milwaukee, WI
Echelon Corporation – Palo Alto, CA
Electro Switch Corporation – Weymouth, MA
Elliott Control Company – Hollister, CA
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Hubbell Incorporated – Madison, OH
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Lexington Switch & Controls – Madison, OH
MagneTek Inc. – New Berlin, WI
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Moeller Electric Corporation – Franklin, MA
Omron Electronics, LLC – Schaumburg, IL
Peerless-Winsmith, Inc. – Warren, OH
Pepperl + Fuchs, Inc. – Twinsburg, OH
Phoenix Contact, Inc. – Harrisburg, PA
Pittman, a Div. of Penn Engineering & Manufacturing Corporation – Harleysville, PA
Post Glover Resistors, Inc. – Erlanger, KY
RENCO Encoders - Goleta, CA
Regal-Beloit Corporation – Bradenton, FL
Reliance Controls Corporation – Racine, WI
Robert Bosch Corporation – Avon, CT

Rockwell Automation – Milwaukee, WI
R Stahl, Inc. – Salem, NH
Russelectric, Inc. – Hingham, MA
Schneider Automation, Inc. – North Andover, MA
SEW-Eurodrive, Inc. – Lyman, SC
Siemens Energy & Automation – Alpharetta, GA
Square D – Lexington, KY
Texas Instruments, Inc. – Attleboro, MA
Torna Tech., Inc. – St. Laurent, Quebec, Canada
Toshiba International Corporation – Houston, TX
Total Control Products Inc. – Milford, OH
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The standards or guidelines presented in a NEMA standards publication are considered technically sound at the time they are approved for publication. They are not a substitute for a product seller's or user's own judgment with respect to the particular product referenced in the standard or guideline, and NEMA does not undertake to guarantee the performance of any individual manufacturer's products by virtue of this standard or guide. Thus, NEMA expressly disclaims any responsibility for damages arising from the use, application, or reliance by others on the information contained in these standards or guidelines.

INTRODUCTION

The standards pertaining to general requirements in NEMA Standards Publication ICS 1 are subdivided into the following clauses:

1 General
Referenced Standards
Scope
Normative References

2 Definitions
Terms which supplement the IEC International Electrical Vocabulary (IEV 441) or assist in clarifying the product standard.

3 Classification
Product classifications where they have been established.

4 Characteristics and Ratings
Descriptions of the kinds of ratings applicable to the product and tables of standard ratings for the product where they have been established.

5 Product Marking, Installation and Maintenance Information
Product information to be provided to assist the user in the installation, use and maintenance of the devices.

6 Service and Storage Conditions
A description of service and storage conditions for which the devices are intended.

7 Construction
Marking, color coding and similar production requirements to be incorporated into the product as manufactured, as well as production test requirements where they have been established, i.e., the rules that the manufacturer follows in producing the product.

8 Performance Requirements and Tests
The performance required to pass each design test specified for the product.

This standards publication contains general requirements that are applicable to the majority of products with the scope of the Industrial Automation Control Products and Systems Section. The product standards that make reference to these general requirements include:

NEMA Standards Title Publication No.

ICS 1 Industrial Control and Systems - General Requirements

ICS 2 Industrial Control and Systems - Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC

ICS 3 Industrial Control and Systems - Factory-built Assemblies

ICS 4 Industrial Control and Systems - Terminal Blocks

ICS 5 Industrial Control and Systems - Control Circuit and Pilot Devices

ICS 6 Industrial Control and Systems - Enclosures

ICS 7 Industrial Control and Systems - Adjustable Speed Drives

ICS 8 Industrial Control and Systems - Crane and Hoist Controllers

ICS 10 Industrial Control and Systems - AC Transfer Switch Equipment

Industrial Control and Systems
General Requirements

1 General

1.1 Referenced standards

The following standards contain provision which, through reference in this text, constitute provisions of this NEMA Standard Publication. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

American National Standards Institute
11 West 42nd Street
New York, NY 10036

C84.1-1995 *Voltage Ratings for Electric Power Systems and Equipment (60 Hz)*

Z535.4-1998 Standard for Product Safety Labels

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

D-3638-1993 *Test Methods for Comparative Tracking Index of Electrical Insulating Materials*

Institute of Electrical and Electronics Engineers
345 East 47th Street
New York. NY 10017

IEEE 100-2000 *Standard Dictionary of Electrical and Electronics Terms (ANSI C42-100)*

International Electrotechnical Commission
1, Rue de Varembe
Geneva, Switzerland

IEC 112-1979 *Methods for Determining the Comparative and the Tracking Indices of Solid Insulating Materials Under Moist Conditions*

IEC 664-1-1992 *Insulation Coordination for Equipment Within Low-Voltage Systems, Part 1: Principles, Requirements and Tests*

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

ANSI/NFPA 70-1999 *National Electrical Code*

ANSI/NFPA 70E-2000 *Electrical Safety Requirements for Employee Workplaces*

Underwriters Laboratories Inc.
333 Pfingsten Rd.
Northbrook, IL 60062

UL 508 - 1999 *Industrial Control Equipment (17th Ed)*

1.2 Scope

The scope of this publication is the scope of the Industrial Automation Control Products and Systems Section. The purpose of this publication is to consolidate all standards of a general nature in order to obtain uniform application of requirements throughout the range of industrial control and systems equipment.

1.3 Relation to Product Standards

The requirements in this publication shall apply to all other NEMA Standards Publications for industrial control and systems equipment unless otherwise specified.

For each type of product, only two main documents are normally necessary to determine all requirements:

a. This general standard, referred to as ICS 1

b. The specific standard applying to the type of product, hereafter referred to as the "relevant product standard" or "product standard."

2 Definitions

(* indicates definition from ANSI/IEEE Standard 100.)

For the purposes of this publication the following definitions apply:

The terms have been arranged in an alphabetical order that reflects common usage. Specialized definitions applying to specific products appear in the standards publications for those products.

accelerating contactor: A contactor, other than the line or directional contactor, used primarily for the purpose of obtaining a change of accelerating torque.

adaptive control systems*: A control system within which automatic means are used to change the system parameters in a way intended to improve the performance of the control system.

alternating current (AC) contactor: A contactor for the specific purpose of establishing and interrupting an AC power circuit.

ambient temperature*: The temperature of the medium such as air, water, or earth into which the heat of the equipment is dissipated.

NOTES

a. For self-ventilated equipment, the ambient temperature is the average† temperature of the air in the immediate vicinity of the equipment.

b. For air- or gas-cooled equipment with forced ventilation or secondary water cooling, the ambient temperature is taken as that of the ingoing air or cooling gas.

c. For self-ventilated enclosed (including oil-immersed) equipment considered as a complete unit, the ambient temperature is the average† temperature of the air outside of the enclosure in the immediate vicinity of the equipment.